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***ABSTRACT:***

*Purpose*: This work has two main objectives: 1) to obtain a set of scales for measuring the patterns, attitudes and practices of integration that can be extrapolated to different scopes (both internal and external) and participants (supplier and customer) within the supply chain; and 2) to evaluate the relations between the different components of integration.

*Design/methodology/approach*: Based on previous literature on the content, measurement and scope of the concept of integration, a model is presented and tested using structural equation modelling. Data were collected from 450 enterprises from the Spanish construction materials sector.

*Findings*: Our results suggest that integration is a multidimensional concept that covers the different organisational levels of the company: corporate through attitudes; strategic through patterns, and operative through practices. These components have a different structure and, although attitudes and patterns behave similarly, practices do not, and so there is no single dimension of integration that includes the three levels. With regard to scope, internal and external integration are related but do not constitute one single concept of integration. It therefore cannot be measured as a single dimension in order to relate the integration of the firm with its (corporate, logistic or marketing) performance.

*Research limitations*: From a methodological point of view, data were collected from a single sector, in a single moment in time and with a single respondent in each company.

*Practical implications*: Patterns and attitudes have a complete, corporative and strategic content, whereas practices are independent from each other and have a more operational vision.

*Originality/value*: Unlike studies that analyse integration and its relationship with outcomes, this work focuses on the concept of integration itself by analysing its three components. Thus, it extends the study of internal and external integration and focuses on the behaviour of the enterprise with two different members of the supply chain (suppliers and customers), thereby extending the analysis beyond the dyad.

**Keywords:** Integration concept, integration measurement, integration scope, scales validation, SEM, reflective indicators, formative indicators, attitudes integration, patterns integration, practices integration.

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## 1. Introduction and aims

Integration has been the core of logistics and supply chain management since the 1980s. It is an important topic both for business management staff and for researchers because it is considered to be a source of improvement for corporate and supply chain performance as well as competitive advantage (Christopher, 1998). For years the relationship between integration and performance has been widely discussed and supported, from both the theoretical (Shapiro, 1984; Scott & Westbrook, 1991; Byrne & Javad, 1992; Ellram & Cooper, 1993; Gustin *et al*., 1994) and the empirical point of view (Stock *et al*., 1998; Frohlich & Westbrook, 2001).

Yet, in recent times a certain amount of criticism has arisen. Some authors think that the improvements that integration brings about in companies' performance and the supply chain are more theoretical than empirical (Christopher & Jüttner, 2000; Fawcett & Magnan, 2002; Power, 2005). Indeed, a number of authors have conducted critical analyses of the literature that offer evidence of the relationship between the two variables and have concluded that it is not as obvious as previously believed, due mainly to the conceptualisation of integration and performance, the different ways of measuring them and the manner in which they are related.

Two of the most relevant studies in this field have been those conducted by Fabbe-Costes and Jahre (2007) and Van der Vaart and Van Donk (2008), who used the content analysis methodology to dissect a total of 52 papers published in 11 highly ranked academic journals in supply chain management. After their analysis, these authors detected several research gaps related with the content, measurement and scope of integration, which is the variable we are dealing with here.

Starting out with integration content, Van der Vaart and Van Donk (2008, p.51) argued that there is little consensus on how to capture the essence of integration. They assessed all the items and factors used to conceptualise integration in the papers they analysed, and classified them in three groups: attitude, pattern or practice. They found that too little consideration has been given to these distinctive roles and to the interactions among them. Fabbe-Costes and Jahre (2007, p.847-848) said that studies define integration in different ways and base their survey questions on a limited number of indicators and operational measures developed from imprecise definitions. Both papers also concluded that authors have failed to build sufficiently upon the research conducted by their predecessors.

Regarding measurement integration, Fabbe-Costes and Jahre (2007, p.842) saw that there was no agreement on whether to use a multi- or a single dimension for the degree of integration. Van der Vaart and Van Donk (2008, p.51) also had doubts about what exactly is being measured and whether integration factors are related to the multiple relationships a company has with its suppliers and/or customers or to a particular or key relationship.

Finally, the scope of integration is unclear. Fabbe-Costes and Jahre (2007, p.847) observed that there are large variations among all the papers they reviewed regarding scope, which could be internal integration (two or more departments), external integration (one or more members of the supply chain) or both. This also confirms the importance of having clearly defined system boundaries, since results can be different depending on the scope.

Taking these gaps as our starting point, we are going to examine the concept of integration

in greater depth. Given the degree of diversity that exists, the purpose of this work is twofold: 1) to obtain a set of scales for measuring the patterns, attitudes and practices of integration that can be extrapolated to different scopes (internal and external, supplier and customer) within the supply chain; and 2) to evaluate the relations between the different components of integration. Thus, this paper intends to fill a gap in the literature. Unlike other studies that analyse integration and its relationship with performance, this work focuses on the concept of integration itself by analysing its three components and the relations between them. It therefore extends the study of internal and external integration and focuses on the behaviour of the enterprise with two different members of the supply chain: suppliers and customers.

To do so, a model is presented and hypotheses are formulated about the relationships between different integration components and ways of measuring them. The method will be based on scales proposed in the literature for measuring patterns, attitudes and practices that can be extrapolated to different scopes of the supply chain. The empirical exercise is based on 450 enterprises from the Spanish construction materials sector and the methodology is grounded on structural equation modelling (SEM). By using such an approach we expect to acquire a wider understanding of the concept of integration and to generate ideas for future research.

The article is structured as follows: first, the current status of the concept of integration and its content, measurement and scope is reviewed. The paper goes on to present the theoretical framework and to state our hypotheses. The methodology is then outlined. The next section contains the main results. After the data analysis, conclusions, limitations and future lines of research are discussed.

## 2. Concept of integration

Integration does not have a single, accepted definition or operationalisation (Pagell, 2004, p.460). However, various definitions share some common themes and there tends to be some overlap among them. Hence, from the theoretical point of view, it is quite widely agreed that integration has been defined mostly in terms of interaction and collaboration, at both the internal level (Kahn & Mentzer, 1996; Ellinger, 2000) and the external level (Daugherty *et al*., 2006). But there does not appear to be any agreement as to whether integration is made up of the two elements or just one of them. Some authors claim that collaboration and interaction should be included (Kahn, 1996; Kahn & Mentzer, 1996; Thomas, 1992; Song & Parry, 1992; Gupta *et al*., 1985; Kahn & McDonough, 1997; Ellinger *et al*., 2000; Pagell, 2004), others defend just interaction (Carlsson, 1991; Moenaert *et al*., 1994; Griffin & Hauser, 1992; Rinehart *et al*., 1989; Bowersox *et al*., 1992; Ruekert & Walker, 1987) and still others only collaboration (Souder *et al*., 1977; Lawrence & Lorsch, 1986; Mintzberg *et al*., 1996; Alder, 1995; Clark & Fujimoto, 1991).

These discrepancies can be explained by the fact that the philosophies underlying the two concepts are different. At the internal integration level, interaction represents aspects of communication associated with interdepartmental activities. The interaction philosophy treats contacts with other departments as transactions, and departments are considered to be independent entities that compete for company resources (Kahn & Mentzer, 1996, p.7). At the external integration level, some authors use the term "socialisation" to refer to the

process that allows information to flow around and between firms. Increased levels of inter-firm socialisation improve the perception (and reality) of the interaction process (Cousins & Menguc, 2006, p.616). Stimulating interaction will correspond to a decision of a tactical nature as it improves horizontal and vertical communication (Kahn & Mentzer, 1996, p.13). On the other hand, as part of internal integration, collaboration is defined as the willingness of departments to work together, which emphasises having mutual understanding, having a common vision, sharing resources, and achieving collective goals. In the collaboration philosophy, continuous ongoing relationships between departments are stressed, rather than transactions between departments, so departments are considered interdependent (Kahn & Mentzer, 1996, p.8). At the external level, the same philosophy can be applied, since collaboration involves two or more companies working together to jointly achieve greater success than can be attained in isolation (Daugherty *et al*., 2006, p.61), resulting in a shift towards cooperative buyer-supplier relationships (Carr & Pearson, 1999; Sodhi & Son, 2009). Lastly, stimulating collaboration is a decision of a strategic nature and will therefore include modifications in the strategic planning process and in its implementation (Kahn & Mentzer, 1996, p.13).

Apart from this duality in the levels of integration – collaboration and interaction – some authors have put forward another dimension after determining that, at the internal level, interdepartmental integration involves predominantly informal processes based on trust, mutual respect and information sharing, the joint ownership of decisions, and collective responsibility for outcomes (Ellinger, 2000; Kahn & Mentzer, 1996; Griffin & Hauser, 1996). And at the external level trust has been defined as *the firm's belief that another company will perform actions that will result in positive actions for the firm, as well as not take unexpected actions that would result in negative outcomes for the firm* (Anderson & Narus, 1991, p.45). Assuming the relationship continues to develop and communication increases, the level of trust between the two parties will grow (Anderson & Narus, 1991). This third dimension reflects the attitude between the parties, based on trust and mutual respect, that is to say, the relational component of integration.

In order to find out what is understood by integration, and following the gaps identified by Van der Vaart and Van Donk (2008) and Fabbe-Costes and Jahre (2007), we are going to analyse the concept of integration according to the different contents, together with its scope and the ways of measuring it.

### 2.1. Integration content

While there is no unanimous agreement about the concept of integration, this is even less the case when it comes to the elements used to operationalise it. Van der Vaart and Van Donk (2008) reached the conclusion that different authors use a wide variety of items and constructs to measure the same thing. They grouped the different factors used to measure integration into three categories – attitudes, patterns and practices – which, due to their content, coincide with the components of integration identified in the theory, namely the relational dimension, collaboration and interaction.

First, Attitudes include items that measure the relationships that buyers and sellers have with each other and/or with the supply chain in general. Examples include trust, commitment or loyalty. Some of the authors who have focused on attitudes as the main element of integration include Maloni and Benton (2000), Shin *et al*. (2000), Jayaram *et al*.

(2004), Johnston *et al*. (2004), Prahinski and Benton (2004), Benton and Maloni (2005), Fynes *et al*. (2005), Kaufmann and Carter (2006) and Ulaga and Eggert (2006). Second, Patterns measure the collaboration between the focal enterprise and its customers/suppliers. They are strategic and organisational processes and systems, such as setting up teams, joint planning or joint decision-making. Authors who identify integration with patterns include Stank *et al*. (2001), Stanley and Wisner (2001), Gimenez and Ventura (2003, 2005) and Li *et al*. (2006). Lastly, Practices are tangible or technological activities that play an important role in the interaction of the focal enterprise with its customers and/or suppliers. Examples include the use of EDI, decisions regarding packaging, or synchronisation of deliveries. Authors that stand out for conceiving integration as practices include: Dong *et al*. (2001), Salvador *et al*. (2001), Frohlich and Westbrook (2001), Vickery *et al*. (2003), Kulp *et al*. (2004); Narasimhan and Nair (2005) or Sanders and Premus (2005).

Van der Vaart and Van Donk (2008) concluded that there is an excessive amount of variation in the ways different authors capture the concept of integration and, although there are authors who have combined two of the dimensions and even the three dimensions, they are still concerned with the influence that attitudes, patterns and practices have on each other. In an earlier study, Van der Vaart *et al*. (2006) considered attitudes to be the first step towards developing the relationship and improving integration, although day-to-day contact through practices and the development of patterns can have an influence on attitudes. For them, each component can go in a different direction, without forming a single concept of integration. On the other hand, Prahinski and Benton (2004) also studied integration as a three-dimensional second-order factor made up of commitment, cooperation and operational linkages. For Lee (2000), integration consists of information sharing, logistics coordination and organisational relationship linkage. This review exposes a gap in the joint study of the three components, since these authors only studied external integration without extending its scope to different members of the supply chain (suppliers and customers) or taking internal integration into account. This work will attempt to close that gap.

### 2.2. Integration measurement

The measurement of integration has been discussed in terms of both its dimensionality and which members of the supply chain it has been measured with. Starting with the issue of dimensionality, some authors consider integration to be made up of a single dimension (Stock *et al*., 2000; Rosenzweig *et al*., 2003; O'Leary-Kelly & Flores, 2002), whereas the vast majority distinguish between, at the very least, internal and external integration.

Within internal integration, the most widely accepted concept is the two-dimensional one, which is made up of the philosophies of interaction and collaboration. For some, the two dimensions form a single concept (second-order factor) where low levels of integration imply low levels of interaction and collaboration and vice-versa (Gupta *et al*., 1986; Clark & Fujimoto, 1991; Song & Parry, 1993). Nevertheless, for other authors (Kahn, 1996; Kahn & Mentzer, 1996) the two philosophies can have different directions, being two first-order factors. On the other hand, the one-dimensional concept considers that internal integration has a single component (interaction or collaboration, for example). The multidimensional concept is less common, but examples can be found, such as the three-dimensional integration proposed by Guinipero and Brand (1996).

With regard to external integration, there is no general agreement about its dimensionality,

since some authors measure it with a single factor (Frohlich & Westbrook, 2001; Gimenez & Ventura, 2005), while others use two (Vickery *et al*., 2003), three (Bagchi & Skjoett-Larsen, 2005), four (Kannan & Tan, 2005), five (Johnston *et al*., 2004) or even six factors. Van der Vaart *et al*. (2006), for example, measured external integration with six dimensions: long-term relationships, cooperative behaviour, joint improvement, information planning, physical integration and communication.

With respect to which participants are to be used to measure integration, Van der Vaart and Van Donk (2008) identified three possibilities: a particular relationship is chosen and used to answer questions about integration (Gimenez & Ventura, 2003, 2005); the key or most important participant is chosen (Chen *et al*., 2004; Bagchi & Skjoett-Larsen, 2005); and the answers refer to all the participants and it is therefore a kind of "mean" of all the relationships with other members of the chain. Gimenez and Ventura (2003, 2005), however, considered that high levels of external integration can be found with some members and low levels with others. This opinion is shared by authors like Kraljic (1983), Anderson and Narus (1991), Cooper and Gardner (1993), Copacino (1997), Dyer *et al*. (1998), Tang (1999) and Masella and Rangone (2000). Therefore, we consider that it is not possible to assign a global level of external integration to an enterprise. Instead, it is necessary to take into account the level of integration of each specific relationship in the supply chain, whether it is a particular relationship or with a participant that plays a key role for the enterprise.

### 2.3. Integration scope

The scope of integration is fully internal and external, up and down the supply chain (Germain & Iyer, 2006).

Starting out with internal integration, Stock *et al*. (1998) and Gimenez and Ventura (2005) measured the level of integration as the range covered by the interactions of the logistics department with other functional areas. Several authors have studied the integration of logistics with other functions, such as marketing (Ellinger *et al*., 2000), operations (Gimenez & Ventura, 2003), information technology (Narasimhan & Kim, 2001), or marketing and operations (Sezen, 2005; Gimenez & Ventura, 2005). Bearing in mind that in the relationship that exists with other members of the supply chain, such as suppliers and customers, the functions of the enterprise that are most frequently in contact with the exterior of the firm are purchasing and marketing, integration between these areas is essential to be able to produce what customers demand, and to do so how and when they want it. Logistics therefore appears as the area that shares responsibility with both of them.

With regard to external integration, Fawcett and Magnan (2002) analysed the difference that exists between the theoretical concept of integration and its actual practice, where three levels of integration are distinguished. The simple form includes the application of new technologies to increase the quality of information and the speed at which it is exchanged with the rest of the members of the channel, that is, integration practices; the second level includes a series of patterns for improving collaboration in the channel: goals are aligned, communication is open, resources are grouped, and risks and rewards are shared, this level being uncommon; and the most advanced level acknowledges that supply chain management is a cultural orientation that guides decision-making. It includes the construction of a higher team, by selecting members of the supply chain and establishing

suitable relationships. To reach this level, the components of the supply chain will have to share the same attitudes towards integration.

As regards the relationship between internal and external integration, most authors have studied it by measuring its impact on the performance of the enterprise, but few of them (Stank *et al*., 2001; Gimenez & Ventura, 2003, 2005; Gimenez, 2006) have related internal and external integration in isolation. Some of the conclusions they have reached are the following: there is a correlation between internal and external integration; internal integration between different areas is positively correlated (for example, logistics-production and logistics-marketing); enterprises with higher internal integration have higher external integration and vice-versa; and enterprises first integrate internally and then externally, as proposed by Stevens (1989) and Narasimhan and Das (2001).

## 3. Theoretical framework and hypotheses development

This work aims to analyse the concept of integration from a wider perspective, taking into consideration the three approaches and combining them with each other. The starting point for the work lies in the scales and indicators shown in Table 1, together with their corresponding scopes. The scale used to measure Patterns is the one developed by Gimenez and Ventura (2003, 2005), the scale by Frohlich and Westbrook (2001) is taken to measure Practices, and Attitudes are evaluated using the indicators proposed by Ulaga and Eggert (2006). All three have been tested and validated in the literature.

TABLE-1

Consequently, the scope of internal integration is seen as being twofold, covering the study of the patterns of integration of the logistics-purchasing departments (hereinafter PIP: Patterns of Internal integration with the Purchasing department) and with that of logistics-marketing (PIM: Patterns of Internal integration with the Marketing department). In parallel to this, external integration presents six different scopes that are obtained by combining the three scales and their measurement with the two members of the supply chain, the key-suppliers and key-customers: PES (Patterns of External integration with key Suppliers), PEC (Patterns of External integration with key Customers), AES (Attitude to External integration with key Suppliers), AEC (Attitude to External integration with key Customers), PrES (Practices of External integration with key Suppliers) and PrEC (Practices of External integration with key Customers). In agreement with the literature, these scopes are related and can be presented by the model shown in Figure 1.

FIGURE-1

Based on the work by Fawcett and Magnan (2002), Van der Vaart *et al*. (2006) and Van der Vaart and Van Donk (2008), our initial hypothesis refers to the existence of three content domains that are considered to be entities in their own right, independent constructs and positively related to one another.

*H1: The Integration concept in the supply chain consists of three content domains, each of which exists in its own right and is positively related to the others: Patterns (P), Attitudes (AE) and Practices (PrE).*

Secondly, we measure internal and external integration with the Patterns construct.

Following on from the works of authors who consider integration to be a two-dimensional construct and thus separate internal from external integration (Stank *et al*., 2001; Gimenez & Ventura, 2003, 2005; Gimenez, 2006), our second hypothesis (H2) takes into account the structure of the Patterns construct, which will be made up of two dimensions: Patterns of Internal versus External Integration.

*H2: Patterns of Integration (P) have a two-dimensional structure, in terms of scope: Internal (PI) versus External (PE).*

Accordingly, the third and fourth hypotheses reflect the structure of these dimensions individually and in parallel. Following Sezen (2005), Gimenez (2006) and Gimenez and Ventura (2005), internal integration will have a two-dimensional structure if it is measured with two different functions of the enterprise (H3), one for each function, thus giving rise to sub-hypotheses (H3.1 and H3.2).

*H3: Patterns of Internal Integration (PI) have a two-dimensional structure in terms of scope, although they do not exist in their own right: Purchasing (PIP) versus Marketing (PIM).*

> *H3.1: Patterns of Internal Integration with Purchasing (PIP) have a one-dimensional structure.*
>
> *H3.2: Patterns of Internal Integration with Marketing (PIM) have a one-dimensional structure.*

On the other hand, External Integration will be two-dimensional if it is measured with two different members of the supply chain (Gimenez, 2006). The external patterns will therefore have two dimensions in terms of the participants: customer-supplier (H4), one dimension being established for integration with suppliers (H4.1) and one with customers (H4.2).

*H4: Patterns of External Integration (PE) have a two-dimensional structure in terms of scope, although they do not exist in their own right: Suppliers (PES) versus Customers (PEC).*

> *H4.1: Patterns of External Integration with Suppliers (PES) have a one-dimensional structure.*
>
> *H4.2: Patterns of External Integration with Customers (PEC) have a one-dimensional structure.*

The following hypotheses have the same structure as Hypothesis 4, but for external integration Attitudes (H5) and Practices (H6). Details are given of the sub-hypotheses, which are associated to the unidimensionality of the scales depending on the participant: attitudes with suppliers (H5.1) and with customers (H5.2), and Practices with suppliers (H6.1) and with customers (H6.2).

*H5: Attitudes of External Integration (AE) have a two-dimensional structure in terms of participants, although they do not exist in their own right: Suppliers (AES) versus Customers (AEC).*

> *H5.1: Attitudes of External Integration with Suppliers (AES) have a one-dimensional structure.*
>
> *H5.2: Attitudes of External Integration with Customers (AEC) have a one-dimensional structure.*

*H6: Practices of External Integration (PrE) have a two-dimensional structure in terms of scope,*

*although they do not exist in their own right: Suppliers (PrES) versus Customers (PrEC).*

*H6.1: Practices of External Integration with Suppliers (PrES) have a one-dimensional structure.*

*H6.2: Practices of External Integration with Customers (PrEC) have a one-dimensional structure.*

## 4. Methodology research design

The population studied is made up of firms from the Spanish building materials sector, which is characterised by being a highly competitive environment with a very heterogeneous range of firms in terms of their features, the assortment of products and services they offer and their geographical dispersion.

Access to this population was made possible thanks to the cooperation of Alimarket (2009a, 2009b), which provided us with a directory of all the firms in this sector registered in Spain. The method chosen for collecting information consisted in conducting a telephone survey of firms selected at random, while ensuring proportional representation by geographical area and by subsector. The fieldwork was carried out during November-December 2009 and a total of 469 completed questionnaires were obtained. After refining the sample and checking for missing values, the final sample consisted of 450 firms with a response rate of 18.84%.

The questionnaire consists of two modules of questions, the first about the characteristics of the enterprise and the second with the items on the patterns, practices and attitudes of integration, bearing in mind the different scopes. These 54 variables are measured by means of seven-point scales, where 1 indicates "Never" and 7 indicates "Always".

The sequence of analysis runs from the indicator to the dimension and from the latter to the different constructs that are posited. Consequently, first, a descriptive and exploratory analysis is performed. Second, the evaluation of the sub-hypotheses will be tested with confirmatory factorial analyses using SEM. The process to be followed will be deductive-inductive with a holistic approach; the system will benefit from feedback and the nature of the indicators and their dimensions (reflective versus formative) will be evaluated.

In the exploratory stage, the dimensional structure of the scales is first approached by principal component analysis. The number of components is defined from the communalities and the percentages of explained variance. Likewise, the Cronbach's-alpha and the item-total correlation coefficients were analysed. The criteria that are going to be followed to refine an item from a scale or, instead, to expand its dimensionality will make up the governing principle of relevance and generality of the scales, together with that of reliability (Bearden *et al*., 2011). Thus, after obtaining the results of these analyses, we can begin to evaluate the nature of the indicators, which may be reflexive or formative. Hence, in this work in order to consider the reflective or formative indicators of a scale, those items or dimensions that fulfil any of the following conditions will also be discussed: percentage of explained variance of the first component below 50% and communalities of the original variables below 0.30. Analysing those values together with an items-total relation below 0.30, an increase in the value of the Cronbach's-alpha after removing the item from the scale, and no scale stability in the scopes under consideration will show whether it is

possible to refine the scale (Churchill, 1979, 1995; Nunnally & Bernstein, 1994).

In the confirmatory stage we used SEM with latent variables. The software application used was EQS 6.2 (Bentler, 1995-2006). More specifically, in this research, given that the assumption of normality cannot hold for the data, we used the Maximum Likelihood estimation method, thus taking the "robust" covariance matrix as our base (Satorra & Bentler, 1994, 2001). For the purpose of evaluating the overall suitability of the proposed models, various statistics and indices are analysed. The corresponding Satorra-Bentler Robust $\chi 2$ is presented for each model. This statistic is affected by the sample and model size (larger samples/model produce larger chi-squares that are more likely to be significant) (MacCallum *et al*., 1996, Hu & Bentler, 1999). Consequently, the following are considered at the same time: the R-RMSEA; the SRMR, and the R-CFI (Bollen, 1989; Browne & Cudeck, 1993; Jöreskog & Sörbom 1996). An R-RMSEA value in the range of 0.05 to 0.10 was considered an indication of fair fit (Hu & Bentler, 1999). Values for the SRMR range from zero to one, with well-fitting models obtaining values below 0.05, although values as high as 0.08 are deemed acceptable (Bollen, 1989, Hair *et al*., 2006). A value of R-CFI greater than or equal to 0.95 is currently recognised as indicative of good fit (Hooper *et al*., 2008).

In order to evaluate the dimensions of a scale that presents reflective indicators, the assessment of the construct is based on the methodology proposed by Bagozzi (1980, 2010) for the validation of multidimensional constructs. The empirical evidence presented here is reliability, together with convergent and discriminant validity. The reliability of the observed variables is evaluated with the standardised factor loadings of the indicators for each construct and their reliability coefficients. The standardised factor loadings will be statistically significant and sufficiently large ($\lambda > 0.70$), thus their coefficients of explained variance must show a clear relation with the underlying factor ($R2 > 0.50$). Two coefficients used to measure the precision for each of the latent variables are: McDonald's omega coefficient (McDonald, 1985), or the composite reliability coefficient (CRC), and Fornell and Larcker's coefficient, commonly known as AVE (Fornell and Larcher, 1981). The recommended values for CRC and AVE were above 0.70 and 0.50, respectively (Bagozzi, 2010). With a given model of measurement, the parameters of interest for the evaluation of discriminant validity are the AVE and the estimation of the squared correlations among the latent variables. Furthermore, it will be analysed to determine whether 1 lies inside all the confidence intervals around the correlation estimate between any two factors (Anderson & Gerbing, 1988).

## 5. Results

### 5.1. Descriptive and exploratory analyses

Table 2 shows the mean scores of the indicators of the Patterns, Attitudes and Practices constructs, taking into account the different scopes considered. The mean of the 28 variables on the Patterns scale is above five. Moreover, the mean levels of the Internal Integration variables are seen to be higher and with less variability than those of External Integration. In the case of the Attitudes scale, higher scores – far beyond five – are observed on all the items, except on the indicator A6. On comparing the mean attitudes

between suppliers and customers, it is found that attitudes are more positive and present less variability with suppliers than with customers. Lastly, greater variability is seen on the Practices scale, the scores also being higher upstream than downstream. The Practices most frequently carried out by the sample that was analysed are Pr1-Pr2-Pr5, whereas the lowest scores are detected on the indicators Pr3-Pr4-Pr7.

TABLE-2

The relations among the indicators of the three scales in each of their scopes, i.e. patterns, practices and attitudes, provide evidence for the existence of different types of latent structures. On the one hand, there are the Attitudes and Patterns scales, and, on the other hand, the Practices scale.

The Attitudes and Patterns scales in all their scopes, where high correlations are observed in terms of the participants and the type of integration, show that the indicators are reflective. In all cases, the percentages of explained variance of the first component are above 50%, the item-component relations above 0.56 and the communalities above 0.30. Likewise, after a joint sequential analysis of these values and the Cronbach's-alphas in the scopes under consideration, it can be deduced that removing some of the items makes it possible to obtain more reliable scales.

On the Practices scale, the highest correlations are observed in terms of the specific practices carried out and not in terms of the participant, which points towards formative indicators. Table 2 shows that the percentages of explained variance of the first component are below 35%; several item-component relations are below 0.5 and, consequently, their communalities are below 0.25. These findings are coherent in both groups of participants. The results of the exploratory analyses in the two scopes highlight the non-existence of a single dimension that includes all the indicators proposed in that scale.

### 5.2. Confirmatory Factor Analysis: Attitudes and Patterns

First, in order to evaluate the dimensional structure of the Attitudes and Patterns scales in confirmatory terms, a First-Order Confirmatory Factor Analysis is estimated with a single latent variable for each of the scopes. The goodness-of-fit statistics and the estimated parameters are presented in Table 3. Given their goodness-of-fit statistics, these models can be rejected even though several of their reliability coefficients present reasonable values. It is found that on both the Attitudes and the Patterns scales, several of the indicators, which were already detected in the exploratory analysis, present certain reliability issues in some of their scopes. Removing these indicators from their respective scopes makes it possible to obtain a better representation of reality.

TABLE-3

After refining the scales, a First-Order Confirmatory Factor Analysis with a single latent variable is estimated again in all the scopes. In all the cases, they go from being rejected to not being rejected; more specifically in five of them even the null hypothesis associated to the chi-square contrast is accepted. With respect to the evidence of reliability and validity of the refined scales, it is interesting to note that the factor loadings of the indicators for each construct were statistically significant. Moreover, the coefficients also had a clear relation with the underlying factor ($R^2 > 0.50$). As can be seen in Table 3, for all latent

variables, CRC were above the recommended 0.70 and the AVE exceeded 0.50. These results, which are consistent with the exploratory analysis that was performed, underline the importance of refining the Attitudes and the Patterns scales.

Accordingly, on evaluating the empirical evidence and the content validity of the scales simultaneously, the decision is made to refine them, since they are sufficiently well represented by means of four items for each one. From the substantive point of view, the removal of those items is not considered to decrease the validity of their content. The dimensions thus obtained are given the following denominations: PIP-PIM-PES-PEC-AES and AEC and the following sub-hypotheses are confirmed: H3.1, H3.2, H4.1, H4.2, H5.1 and H5.2.

Once the first-order dimensional structure has been evaluated and the scales have been refined in terms of the different scopes, the next step is to perform a sequential analysis of their first- and second-order structures, taking into account scopes and participants jointly.

The goodness-of-fit statistics of the First-Order Confirmatory Factor Analysis with a two latent variable, the Attitudes towards External Integration in terms of the Participants scale, provide evidence of fair fit (Table 4). The factor loadings were sufficiently large ($R^2 >$ 0.53), the CRCs were above 0.78 and the AVEs exceeded 0.61. With regard to evaluating discriminant validity, the AVEs are above the squared correlation among the latent variables and furthermore 1 is not within the confidence intervals around the correlation estimate between AES and AEC. Nevertheless, such a correlation is important because the correlation (0.64) reveals the potential existence of a second-order factor (AE) with two first-order latent variables. The new model, a Second-Order Confirmatory Factor Analysis, with tau-equivalent latent variables, is estimated and offers high convergent validity and reliability indices. It can therefore be concluded that there is a higher-order construct called AE and, hence, H5 is confirmed.

TABLE-4

The second-order structure on the Patterns scale is analysed in a similar way to the method described in the analysis of the Attitudes scale. Thus, two First-Order Confirmatory Factor Analyses are estimated with two latent variables: on the one hand, Patterns towards Internal Integration in terms of the departments and, on the other, Patterns towards External Integration in terms of the Participants. The goodness-of-fit statistics of these models provide evidence of fair fit. The results of the confirmatory factorial analyses of the indicators from the Patterns scale provide evidence of the existence of second-order structures. The factor loadings, percentages of explained variance, coefficients of reliability of the dimensions and the AVEs are adequate. In addition, 1 is outside the confidence intervals around the correlation estimate between PIP-PIM (0.75) and PES-PEC (0.65), which indicates that construct validity and reliability are obtained. Nevertheless, these correlations among the Patterns scales are important and provide evidence of the existence of a higher-order structure associated to the type of integration, regardless of the department or the external participant with which it is performed. This entails evaluating the second-order structures, the results being consistent throughout the whole sequence of analyses.

To evaluate the existence of this higher-order structure, the new models are two Second-Order Confirmatory Factor Analyses with tau-equivalent latent variables. Thus, these

models are estimated and offer high convergent validity and reliability indices (AVEs-CRCs). It can therefore be concluded that there are two higher-order constructs called PI and PE, and hence H3 and H4 are confirmed.

With the aim of testing H2, a new confirmatory factor analysis model is estimated. The results can be seen in Table 5. The first model is a First-Order Confirmatory Factor Analysis with four latent variables (PIP-PIM-PES-PEC). This complex model summarises the whole factorial structure of the Patterns scale and covers the two models that were estimated earlier (PI-PE). The goodness-of-fit statistics of this model provide evidence of fair fit. With regard to the estimated parameters, it should be noted that stability is observed with respect to the previously estimated models. Findings support the existence of a second-order dimensional structure that represents the relationships observed among the items in an acceptable manner. Thus, two second-order constructs representing PI versus PE can be considered; there is no construct of a higher order (PI-PE = 0.32) called Patterns of Integration. This allows Hypotheses H3 and H4 to be confirmed, but not H2.

TABLE-5

After obtaining the results from the partial analyses of the Patterns and Attitudes constructs, the next step is to analyse the joint relations. In this case, the model is a Second-Order Confirmatory Factor Analysis, with three Second-Order latent variables (PI-PE-AE) and six First-Order latent variables (PIP-PIM-PES-PEC-AES-AEC) (Figure 2). This model has 243 degrees of freedom and the SRMR is below 0.06. The most important information is that it can be seen how the structures from the previous analyses (reliability and convergent validity) are maintained and, in addition, in this case there is also proof of their discriminant and predictive validity. The correlation between AE and PE (0.41) is higher than that between AE and PI (0.33) or between PI and PE (0.34), all of them being positive. Figure 2 shows a summary of the results obtained and therefore H1 is partially confirmed.

FIGURE-2

### 5.3. Confirmatory Factor Analysis: Practices

To evaluate the dimensional structure of the Practices scale in confirmatory terms, first a First-Order Confirmatory Factor Analysis is estimated with a single latent variable in each scope. These models cannot be rejected, but all of their reliability coefficients present unreasonable values. As can be seen in Table 6, for the two latent variables, the CRCs were well below the recommended 0.70 and the same occurs with the AVE. In this case, early evidence is related with the need to extend the dimensionality of the scale because there is an insufficient common core of relationship between them. This must be carried out under the principle of content validity, that is to say, it is necessary to ensure that its domain is defined.

All the items from Practices are then analysed simultaneously, bearing in mind the fact that the indicators of the scale may be formative and not reflective. The model is a First-Order Confirmatory Factor Analysis with six latent variables. The SRMR and R-CFI indicate fair fit of the model. The estimated parameters show that: the factor loadings are above 0.81, consequently, the percentages of explained variance are above 0.66; the coefficients of reliability of the dimensions are more than appropriate (CRCs-AVEs); the AVEs are above

the squared correlation among the latent variables and of course 1 is outside the confidence intervals around the correlation estimate between any two latent variables.

TABLE-6

Results of a joint analysis of the 14 indicators show that those indicators cannot be considered to reflect a single dimension, but instead there are six dimensions. These dimensions reflect the indicators associated to the types of practices carried out by the enterprise, regardless of the participant with which they are performed. Thus, at this first level it can be said that we are dealing with reflective indicators. Six dimensions can therefore be defined: Production Plans are shared; EDI is used; Knowledge of our Inventory levels; Packaging Customisation; Delivery Frequencies are established; and the use of Logistics Services and Equipment is shared. Table 6 shows the correlations among their components. These results do not confirm sub-hypotheses H6.1, H6.2 or therefore H6. H1 also remains partially unconfirmed.

## 6. Discussion and Conclusion

From a theoretical point of view, the aim of this paper is to try to provide an answer to three issues: content, measure and scope of integration.

First, this research offers a wider view of its content, since we can say that integration has a three-dimensional structure, each dimension illustrating a different approach to the concept of integration. Attitudes can therefore be assigned to the corporate philosophy, with a relational dimension; Patterns can be linked to the more strategic part and with the collaboration dimension; and Practices is related to the more operative part or the interaction dimension. This three-dimensional concept coincides with that of Van der Vaart *et al*. (2006) and that of Fawcett and Magnan (2002) in their study of integration in the day-to-day practice of firms. This concept integrates the two-dimensional vision of integration as collaboration and interaction (Kahn & Mentzer, 1996) and the relational vision of integration (Benton & Maloni, 2005; Shin *et al*., 2000).

The second issue concerns the way integration is measured. First, the Attitudes towards External integration scale (AES and AEC) consists of four reflective indicators (their relationships to be mutually beneficial, trusting, with a commitment from both parties and an interest in expanding them). Attitude towards external integration (AE) is a second-order factor with two dimensions, depending on whether it is measured upstream (AES) or downstream (AEC). These findings differ from those of authors who measure attitude as a single dimension (Benton & Maloni, 2005; Shin *et al*., 2000) without taking both sides of the supply chain into account. The scale of Patterns towards internal (PIP and PIM) and/or external integration (PES and PEC) of the enterprise is also defined by four reflective indicators (joint planning, goal-setting, definition of responsibilities and joint decision-making are carried out). In enterprises that display Patterns of Internal Integration (PI), no distinction is made between the Purchasing (PIP) and Marketing Departments (PIM). This coincides with the work of Sezen (2005) and Gimenez (2006) but, unlike them, in our study there is a second-order factor that groups the concept of internal integration (PI) that does not exist in these earlier works and which indicates that the higher internal integration with both departments is, the higher the patterns of internal integration (PI) will be. The same

thing happens in terms of Patterns of External Integration (PE). Bagchi and Skjoett-Larsen (2005) used the dimensions Collaboration with key customers and Collaboration with key suppliers to measure PES and PEC separately. Unlike our study, however, they did not identify a second-order factor that unified the two dimensions of external integration. Lastly, and with regard to the Practices scale, if the enterprise carries out a particular practice/action it is carried out both upstream (Key-Suppliers) and downstream (Key-Customers). In parallel, the practices that are carried out are not reflective indicators of the Practices scale, they are formative, and therefore there does not have to be a link between certain types of practices and others. Some practices may occur while others do not, whereas patterns and attitudes are compact concepts that occur in all the scopes under study. This result differs from that obtained by Frohlich and Westbrook (2001), who identified two external practice factors (with suppliers and customers) using the same scale.

The third issue is the scope of the integration. In this study we have examined internal integration, external integration with suppliers and external integration with customers. First, although the Patterns towards internal integration (PI) are positively related to the Patterns towards external integration (PE), there is no general pattern for both of them. It cannot therefore be stated that the greater integration is, the greater internal and external integration will be, in line with the works of Stank *et al*. (2001), Narasimhan and Das (2001), Gimenez and Ventura (2005) and Germain and Iyer (2006), who did not identify a single integration factor that groups internal and external integration. Second, there are positive relations between the Patterns and Attitudes constructs and between internal and external integration. Specifically, this research contributes to the existing literature (Van der Vaart *et al*., 2006) by considering the relationship between these components. It has been shown that there is a positive relation between external patterns and external attitudes towards integration (PE-AE), and that this relation is greater than the one that exists between internal and external patterns (PI-PE) or between internal patterns and external attitudes (PI-AE). As regards the relation between practices and the other two components of integration (attitudes and patterns), the results are not so clear since practices are independent from one another. Third, enterprises that display positive or negative integration attitudes (AE) and positive or negative patterns of external integration (PE) do not make any distinction among the members of the supply chain, that is to say, they do not distinguish between key suppliers and customers.

From a methodological point of view, by testing the different hypotheses we have shown the structure of the concept of integration, first by validating and refining scales and also by observing the existence of first- and second-order factors for patterns and attitudes (Hypotheses H3, H4 and H5 and their corresponding sub-hypotheses are confirmed). Practices, however, do not display the same behaviour, and Hypothesis H6 has therefore not been confirmed. Similarly, it has not been possible to confirm the existence of a global concept of integration that includes internal and external integration (H2) or a global component of integration that includes attitudes, patterns and practices (H1), unlike Prahinski and Benton (2004), who used a single factor called Buyer-supplier relationship to include the three elements of integration. As we see it, integration is a multidimensional concept and therefore the relation measured with the performance (where the greater integration is, the better the results will be) will depend on the type of integration that is being measured: attitudes, patterns, practices, internal integration or external integration, integration with suppliers or integration with customers. This result helps to further our

knowledge about the use of the components of integration and casts doubts on some studies that measure integration with a single factor without taking the rest of the components into account (Rosenzweig *et al*., 2003; O'Leary-Kelly & Flores, 2002).

From a managerial point of view, our results can be used to justify the need to match the concept of integration with its different levels, to the company philosophy and strategies. It could be concluded that attitudes towards integration take place at the corporate level, patterns are found at the strategic level and practices occur on the operative level. In addition, the design of both internal and external integration must take into account the interactions among attitudes, patterns and practices, as well as the integration both upstream and downstream in the supply chain. Adopting integration requires an attitude first within the companies and an effort among participating companies in order to strengthen ties with suppliers and customers (Hernández-Espallardo *et al*., 2010).

This research, like any other, has its limitations, both in methodological and conceptual terms. As far as methodological limitations are concerned, data were collected from a single sector, in a single moment in time, and with a single respondent in each company. First, this sector is one of the most severely hit by the crisis in Spain and although its effects were not so serious in 2009 as in later years, perceptions collected in the surveys were already influenced by what was to come. Second, it is a cross-sectional study, that is, it does not allow us to see the evolution of integration in firms and therefore we cannot analyse the order in which the three components – attitudes, patterns and practices – are implemented. Neither is it possible to see which comes first: internal or external integration or integration with suppliers and with customers. Last, Van der Vaart and Van Donk (2008) believe that the quality of the information would be improved if several respondents were used. On the other hand, from the theoretical point of view, in this work, internal integration has been conceptualised as patterns and it has been measured by the collaboration between the logistics-purchasing and logistics-marketing departments. This seems to imply that other results could be obtained if measurements were performed with attitudes or with practices and with other departments.

The results also highlight opportunities for further exploration of the concept of Supply Chain Integration. First, the evolution of the components and the scope of integration within the company could be studied. Which takes place first: internal or external integration? Do practices generate attitudes and then patterns, or are patterns created from certain attitudes which are later detailed in practices? Second, would the same results be achieved if internal and external integration was studied using attitudes or practices? Third, is the composition of patterns, attitudes and practices the same for a company that acts as a manufacturer in the supply chain as for one that acts as a distributor? Fourth, there is still a lot of work to be done on the study of the influence of integration on performance. Which of the three components has the biggest influence on the results: attitudes, patterns or practices? What influence does internal and external integration with suppliers and with customers have on results? Lastly, in the literature it has been proposed that implementing integration both upstream and downstream is better than concentrating the firm's efforts on integrating customers or suppliers only (Frohlich & Westbrook, 2001; Rosenzweig *et al*., 2003). Following Danese and Romano (2011), one key question is: are there synergies that a firm could or should exploit by implementing both customer and supplier integration simultaneously? Further research is needed in this area.

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## TABLE 1: Constructs, Indicators and Scope of Internal and External Integration

| CONSTRUCT | ITEMS | SCOPES ANALYSED |
|---|---|---|
| **PATTERNS**<br><br>(Gimenez & Ventura,<br><br>2003, 2005) | P1 Informal teamwork<br>P2 Shared ideas, information<br>P3 Established teamwork<br>P4 Joint planning to anticipate and resolve operative problems<br>P5 Joint establishment of objectives<br>P6 Joint development of the responsibilities' understanding<br>P7 Joint decisions | **INTERNAL:**<br>• **LOGISTICS-PURCHASING**<br>• **LOGISTICS-MARKETING**<br>**EXTERNAL:**<br>• **SUPPLIER**<br>• **CUSTOMER** |
| **ATTITUDES**<br><br>(Ulaga & Eggert , 2006) | A1 Our key agent keeps promises it makes to our firm<br>A2 The relationship with our key agent is mutually successful<br>A3 Our key agent is trustworthy<br>A4 The relationship with our key agent is something to which we are very committed<br>A5 Our firm expects to maintain or expand its business with the key agent<br>A6 The relationship with our key agent is very much like being family | **EXTERNAL:**<br>• **SUPPLIER**<br>• **CUSTOMER** |
| **PRACTICES**<br><br>(Frolich & Westbrook , 2001) | Pr1 Sharing production plans<br>Pr2 Joint EDI access/networks<br>Pr3 Knowledge of inventory mix/levels<br>Pr4 Packaging customisation<br>Pr5 Delivery frequencies<br>Pr6 Common logistical equipment/containers<br>Pr7 Common use of third-party logistics | **EXTERNAL:**<br>• **SUPPLIER**<br>• **CUSTOMER** |

## TABLE 2: Descriptive Statistics and Exploratory Analysis (PCA)

**INTERNAL INTEGRATION**

| | LOGISTICS-PURCHASING | | | | | | | | LOGISTICS-MARKETING | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PCA-S | | PCA-S$^2$ | | PCA-S$^3$ | | | | PCA-S | | PCA-S$^2$ | | PCA-S$^3$ | |
| **PAT** | **M** | **STD** | **1-CP** | **C** | **1-CP** | **C** | **1-CP** | **C** | **M** | **STD** | **1-CP** | **C** | **1-CP** | **C** | **1-CP** | **C** |
| **P1** | 5.88 | 1.20 | 0.58 | 0.34 | - | - | - | - | 5.76 | 1.13 | 0.64 | 0.41 | - | - | - | - |
| **P2** | 5.60 | 1.34 | 0.68 | 0.46 | 0.68 | 0.46 | - | - | 5.50 | 1.30 | 0.78 | 0.61 | 0.77 | 0.59 | - | - |
| **P3** | 6.10 | 0.84 | 0.55 | 0.30 | - | - | - | - | 5.97 | 0.77 | 0.60 | 0.36 | - | - | - | - |
| **P4** | 6.12 | 0.78 | 0.80 | 0.64 | 0.84 | 0.71 | 0.83 | 0.69 | 5.90 | 0.78 | 0.82 | 0.67 | 0.84 | 0.71 | 0.83 | 0.69 |
| **P5** | 6.08 | 0.78 | 0.82 | 0.67 | 0.85 | 0.72 | 0.87 | 0.76 | 5.93 | 0.68 | 0.85 | 0.72 | 0.89 | 0.79 | 0.90 | 0.81 |
| **P6** | 6.08 | 0.80 | 0.80 | 0.64 | 0.84 | 0.71 | 0.86 | 0.74 | 5.92 | 0.74 | 0.81 | 0.66 | 0.85 | 0.72 | 0.88 | 0.77 |
| **P7** | 6.11 | 0.83 | 0.82 | 0.67 | 0.85 | 0.72 | 0.88 | 0.77 | 5.90 | 0.78 | 0.82 | 0.67 | 0.86 | 0.74 | 0.88 | 0.77 |
| **% EV** | | | 54% | | 65% | | 74% | | | | 58% | | 71% | | 76% | |
| $\alpha$ | | | 0.82 | | 0.87 | | 0.88 | | | | 0.85 | | 0.89 | | 0.89 | |

**EXTERNAL INTEGRATION**

| | SUPPLIER | | | | | | | | CUSTOMER | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PCA-S | | PCA-S$^2$ | | PCA-S$^3$ | | | | PCA-S | | PCA-S$^2$ | | PCA-S$^3$ | |
| **PAT** | **M** | **STD** | **1-CP** | **C** | **1-CP** | **C** | **1-CP** | **C** | **M** | **STD** | **1-CP** | **C** | **1-CP** | **C** | **1-CP** | **C** |
| **P1** | 5.69 | 1.38 | 0.56 | 0.31 | - | - | - | - | 3.88 | 1.71 | 0.64 | 0.41 | - | - | - | - |
| **P2** | 5.26 | 1.54 | 0.77 | 0.59 | 0.77 | 0.59 | - | - | 5.40 | 1.09 | 0.81 | 0.66 | 0.80 | 0.64 | - | - |
| **P3** | 5.80 | 1.06 | 0.70 | 0.49 | - | - | - | - | 5.81 | 0.97 | 0.79 | 0.62 | - | - | - | - |
| **P4** | 5.74 | 1.08 | 0.86 | 0.74 | 0.88 | 0.77 | 0.87 | 0.76 | 5.64 | 0.99 | 0.89 | 0.79 | 0.90 | 0.81 | 0.89 | 0.79 |
| **P5** | 5.69 | 1.07 | 0.86 | 0.74 | 0.88 | 0.77 | 0.89 | 0.79 | 5.87 | 0.96 | 0.87 | 0.76 | 0.90 | 0.81 | 0.91 | 0.83 |
| **P6** | 5.64 | 1.12 | 0.85 | 0.72 | 0.88 | 0.77 | 0.91 | 0.83 | 5.80 | 0.99 | 0.84 | 0.71 | 0.88 | 0.77 | 0.89 | 0.79 |
| **P7** | 5.70 | 1.11 | 0.84 | 0.71 | 0.86 | 0.74 | 0.88 | 0.77 | | | 0.86 | 0.74 | 0.88 | 0.77 | 0.90 | 0.81 |
| **% EV** | | | 61% | | 73% | | 79% | | | | 67% | | 76% | | 81% | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\alpha$ | | | 0.88 | | 0.91 | | 0.91 | | | | 0.91 | | 0.92 | | 0.92 | |
| | **SUPPLIER** | | | | | | | | **CUSTOMER** | | | | | | | |
| | | | **PCA-S** | | **PCA-S[1]** | | **PCA-S[2]** | | | | **PCA-S** | | **PCA-S[1]** | | **PCA-S[2]** | |
| **ATT** | **M** | **STD** | **1-CP** | **C** | **1-CP** | **C** | **1-CP** | **C** | **M** | **STD** | **1-CP** | **C** | **1-CP** | **C** | **1-CP** | **C** |
| **A1** | 5.89 | 0.90 | 0.74 | 0.55 | 0.76 | 0.58 | - | - | 5.40 | 1.09 | 0.74 | 0.55 | 0.76 | 0.58 | - | - |
| **A2** | 6.08 | 0.76 | 0.82 | 0.67 | 0.83 | 0.69 | 0.83 | 0.69 | 5.81 | 0.97 | 0.87 | 0.76 | 0.88 | 0.77 | 0.89 | 0.79 |
| **A3** | 5.97 | 0.84 | 0.83 | 0.69 | 0.84 | 0.71 | 0.82 | 0.67 | 5.64 | 0.99 | 0.86 | 0.74 | 0.86 | 0.74 | 0.84 | 0.71 |
| **A4** | 6.11 | 0.78 | 0.84 | 0.71 | 0.84 | 0.71 | 0.87 | 0.76 | 5.87 | 0.96 | 0.88 | 0.77 | 0.88 | 0.77 | 0.91 | 0.83 |
| **A5** | 6.03 | 0.84 | 0.82 | 0.67 | 0.81 | 0.66 | 0.84 | 0.71 | 5.80 | 0.99 | 0.88 | 0.77 | 0.88 | 0.77 | 0.90 | 0.81 |
| **A6** | 4.00 | 1.81 | 0.38 | 0.14 | - | - | - | - | 3.88 | 1.71 | 0.45 | 0.20 | - | - | - | - |
| **% EV** | | | 57% | | 67% | | 70% | | | | 63% | | 73% | | 79% | |
| $\alpha$ | | | 0.75 | | 0.87 | | 0.86 | | | | 0.84 | | 0.91 | | 0.91 | |

| | **SUPPLIER** | | | | **CUSTOMER** | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **PCA-S** | | | | **PCA-S** | |
| **PRA** | **M** | **STD** | **1-CP** | **C** | **M** | **STD** | **1-CP** | **C** |
| **Pr1** | 5.58 | 1.20 | 0.53 | 0.28 | 5.43 | 1.30 | 0.52 | 0.27 |
| **Pr2** | 5.19 | 2.17 | 0.47 | 0.22 | 5.08 | 2.20 | 0.38 | 0.14 |
| **Pr3** | 3.16 | 1.86 | 0.32 | 0.10 | 3.11 | 1.83 | 0.31 | 0.10 |
| **Pr4** | 3.51 | 2.10 | 0.43 | 0.18 | 3.77 | 2.17 | 0.47 | 0.22 |
| **Pr5** | 6.00 | 1.56 | 0.53 | 0.28 | 5.78 | 1.59 | 0.50 | 0.25 |
| **Pr6** | 4.14 | 2.10 | 0.80 | 0.64 | 3.99 | 2.07 | 0.79 | 0.62 |
| **Pr7** | 4.08 | 2.02 | 0.84 | 0.71 | 3.96 | 1.98 | 0.84 | 0.71 |
| **% EV** | | | 34% | | | | 33% | |
| $\alpha$ | | | 0.64 | | | | 0.62 | |

M: Means; STD: Standard Deviations.

PCA: Principal Component Analysis; 1-CP: First-Component Principal; C: Communalities

S: Full Scale; $S^i$: Refined Scale "i" items.

% EV: Percentages of explained variance; $\alpha$ : Cronbach´s Alpha coefficients.

## TABLE 3: First-Order CFA: Attitudes and Patterns

**INTERNAL INTEGRATION**

**PATTERNS PURCHASE (PIP)**

| | 1-OR. CFA. PIP-S | | 1-OR. CFA. PIP-S* | |
|---|---|---|---|---|
| | PIP | $R^2$ | PIP* | $R^2$ |
| PIP1 | 0.42 | 0.18 | | |
| PIP2 | 0.59 | 0.35 | | |
| PIP3 | 0.39 | 0.15 | | |
| PIP4 | 0.77 | 0.59 | 0.76 | 0.59 |
| PIP5 | 0.82 | 0.67 | 0.82 | 0.68 |
| PIP6 | 0.79 | 0.62 | 0.80 | 0.64 |
| PIP7 | 0.83 | 0.69 | 0.84 | 0.71 |
| AVE | 0.46 | | 0.66 | |
| CRC | 0.66 | | 0.81 | |
| | R- $\chi^2_{14}$ : 167.98; R-RMSEA: 0.16; SRMR: 0.12; R-CFI: 0.53. | | R- $\chi^2_2$ : 6.06 (p>0.04); R-RMSEA: 0.07; SRMR: 0.02; R-CFI= 0.97. | |

**PATTERNS MARKETING (PIM)**

| | 1-OR. CFA. PIM-S | | 1-OR. CFA. PIM-S* | |
|---|---|---|---|---|
| | PIM | $R^2$ | PIM** | $R^2$ |
| PIM1 | 0.42 | 0.18 | | |
| PIM2 | 0.63 | 0.40 | | |
| PIM3 | 0.42 | 0.18 | | |
| PIM4 | 0.79 | 0.62 | 0.75 | 0.56 |
| PIM5 | 0.86 | 0.74 | 0.86 | 0.74 |
| PIM6 | 0.81 | 0.66 | 0.84 | 0.71 |
| PIM7 | 0.82 | 0.67 | 0.85 | 0.72 |
| AVE | 0.49 | | 0.68 | |
| CRC | 0.68 | | 0.83 | |
| | R- $\chi^2_{14}$ : 135.82; R-RMSEA: 0.14; SRMR: 0.11; R-CFI= 0.62. | | R- $\chi^2_2$ : 8.54 (p>0.01); R-RMSEA: 0.08; SRMR: 0.02; R-CFI= 0.95. | |

**EXTERNAL INTEGRATION**

**PATTERNS SUPPLIER (PES)**

| | 1-OR. CFA. PES-S | | 1-OR. CFA. PES-S* | |
|---|---|---|---|---|
| | PES | $R^2$ | PES** | $R^2$ |
| PES1 | 0.44 | 0.19 | | |
| PES2 | 0.69 | 0.48 | | |
| PES3 | 0.62 | 0.38 | | |
| PES4 | 0.84 | 0.71 | 0.81 | 0.66 |
| PES5 | 0.85 | 0.72 | 0.84 | 0.70 |
| PES6 | 0.85 | 0.72 | 0.89 | 0.78 |
| PES7 | 0.83 | 0.69 | 0.85 | 0.72 |
| AVE | 0.56 | | 0.72 | |
| CRC | 0.73 | | 0.85 | |
| | R- $\chi^2_{14}$ : 88.15; R-RMSEA: 0.11; SRMR: 0.10; R-CFI: 0.85. | | R- $\chi^2_2$ : 10.83; R-RMSEA: 0.09; SRMR: 0.03; R-CFI= 0.97. | |

**PATTERNS CUSTOMER (PEC)**

| | 1-OR. CFA. PEP-S | | 1-OR. CFA. PEP-S* | |
|---|---|---|---|---|
| | PEC | $R^2$ | PEC** | $R^2$ |
| PEC1 | 0.53 | 0.28 | | |
| PEC2 | 0.73 | 0.53 | | |
| PEC3 | 0.68 | 0.46 | | |
| PEC4 | 0.89 | 0.79 | 0.86 | 0.74 |
| PEC5 | 0.88 | 0.77 | 0.89 | 0.79 |
| PEC6 | 0.83 | 0.69 | 0.85 | 0.72 |
| PEC7 | 0.84 | 0.71 | 0.86 | 0.74 |
| AVE | 0.61 | | 0.75 | |
| CRC | 0.77 | | 0.87 | |
| | R- $\chi^2_{14}$ : 63.82; R-RMSEA: 0.09; SRMR: 0.08; R-CFI= 0.92. | | R- $\chi^2_2$ : 7.44 (p>0.02); R-RMSEA: 0.07; SRMR: 0.03; R-CFI= 0.99. | |

**ATTITUDES SUPPLIER (AES)**

**ATTITUDES CUSTOMER (AEC)**

| | 1-OR. CFA. AES-S | | 1-OR. CFA. AES-S* | |
|---|---|---|---|---|
| | **AES** | $R^2$ | **AES**** | $R^2$ |
| **AES1** | 0.67 | 0.45 | | |
| **AES2** | 0.77 | 0.59 | 0.75 | 0.56 |
| **AES3** | 0.78 | 0.61 | 0.74 | 0.55 |
| **AES4** | 0.81 | 0.66 | 0.84 | 0.71 |
| **AES5** | 0.77 | 0.59 | 0.79 | 0.62 |
| **AES6** | 0.31 | 0.10 | | |
| **AVE** | 0.50 | | 0.61 | |
| **CRC** | 0.69 | | 0.78 | |
| | R- $\chi^2_9$ : 51.33; R-RMSEA: 0.10; SRMR: 0.06; R-CFI: 0.90. | | R- $\chi^2_2$ : 6.57 (p>0.03); R-RMSEA: 0.07; SRMR: 0.02; R-CFI= 0.99. | |

| | 1-OR. CFA. AEC-S | | 1-OR. CFA. AEC-S* | |
|---|---|---|---|---|
| | **AEC** | $R^2$ | **AEC**** | $R^2$ |
| **AEC1** | 0.65 | 0.42 | | |
| **AEC2** | 0.85 | 0.72 | 0.84 | 0.71 |
| **AEC3** | 0.79 | 0.62 | 0.76 | 0.58 |
| **AEC4** | 0.89 | 0.79 | 0.91 | 0.83 |
| **AEC5** | 0.87 | 0.76 | 0.88 | 0.77 |
| **AEC6** | 0.38 | 0.14 | | |
| **AVE** | 0.58 | | 0.72 | |
| **CRC** | 0.74 | | 0.85 | |
| | R- $\chi^2_9$ : 77.62; R-RMSEA: 0.13; SRMR: 0.06; R-CFI= 0.88. | | R- $\chi^2_2$ : 8.96 (p>0.01); R-RMSEA: 0.08; SRMR: 0.02; R-CFI= 0.98. | |

1-OR. CFA. First-Order Confirmatory Factor Analysis.

S: Full Scale; S* Refined Scale

## TABLE 4: First And Second Order CFA: Attitudes and Patterns.

### ATTITUDES

**1-OR. CFA. AES-AEC**

| | AES | AEC | $R^2$ |
|---|---|---|---|
| **AES2** | 0.74 | | 0.55 |
| **AES3** | 0.73 | | 0.53 |
| **AES4** | 0.85 | | 0.72 |
| **AES5** | 0.80 | | 0.64 |
| **AEC2** | | 0.84 | 0.71 |
| **AEC3** | | 0.75 | 0.56 |
| **AEC4** | | 0.91 | 0.83 |
| **AEC5** | | 0.88 | 0.77 |
| **AES** | 1 | | |
| **AEC** | 0.64 | 1 | |
| **AVE** | 0.61 | 0.72 | |
| **CRC** | 0.78 | 0.85 | |

**2-OR. CFA. AE***

| | AES | AEC | AE | $R^2$ |
|---|---|---|---|---|
| **AES2** | 0.74 | | | 0.55 |
| **AES3** | 0.73 | | | 0.53 |
| **AES4** | 0.85 | | | 0.72 |
| **AES5** | 0.80 | | | 0.64 |
| **AEC2** | | 0.84 | | 0.70 |
| **AEC3** | | 0.75 | | 0.56 |
| **AEC4** | | 0.91 | | 0.83 |
| **AEC5** | | 0.88 | | 0.77 |
| **AES** | | | 0.96 | 0.92 |
| **AEC** | | | 0.67 | 0.45 |
| **AVE** | 0.61 | 0.72 | 0.69 | |
| **CRC** | 0.78 | 0.85 | 0.82 | |

R- $\chi^2_{19}$ : 436.95; R-RMSEA: 0.12; SRMR: 0.06; R-CFI= 0.62

### PATTERNS

**1-OR. CFA. PIP-PIM**

| | PIP | PIM | $R^2$ |
|---|---|---|---|
| **PIP4** | 0.76 | | 0.58 |
| **PIP5** | 0.82 | | 0.67 |
| **PIP6** | 0.80 | | 0.64 |
| **PIP7** | 0.84 | | 0.70 |
| **PIM4** | | 0.75 | 0.56 |
| **PIM5** | | 0.86 | 0.74 |
| **PIM6** | | 0.83 | 0.70 |
| **PIM7** | | 0.85 | 0.72 |
| **PIP** | 1 | | |
| **PIM** | 0.75 | 1 | |
| **AVE** | 0.65 | 0.68 | |
| **CRC** | 0.81 | 0.82 | |

**2-OR. CFA. PI***

| | PIP | PIM | PI | $R^2$ |
|---|---|---|---|---|
| **PIP4** | 0.76 | | | 0.58 |
| **PIP5** | 0.84 | | | 0.71 |
| **PIP6** | 0.89 | | | 0.79 |
| **PIP7** | 0.85 | | | 0.72 |
| **PIM4** | | 0.75 | | 0.56 |
| **PIM5** | | 0.86 | | 0.74 |
| **PIM6** | | 0.84 | | 0.71 |
| **PIM7** | | 0.85 | | 0.72 |
| **PIP** | | | 0.86 | 0.74 |
| **PIM** | | | 0.87 | 0.76 |
| **AVE** | 0.65 | 0.72 | 0.75 | |
| **CRC** | 0.84 | 0.83 | 0.87 | |

R- $\chi^2_{19}$ : 115.88; R-RMSEA: 0.10; SRMR: 0.03; R-CFI= 0.73

**1-OR. CFA. PES-PEC**

**2-OR. CFA. PE***

| | PES | PEC | $R^2$ |
|---|---|---|---|
| **PES4** | 0.81 | | 0.66 |
| **PES5** | 0.84 | | 0.70 |
| **PES6** | 0.89 | | 0.78 |
| **PES7** | 0.85 | | 0.72 |
| **PEC4** | | 0.85 | 0.73 |
| **PEC5** | | 0.87 | 0.76 |
| **PEC6** | | 0.86 | 0.73 |
| **PEC7** | | 0.87 | 0.76 |
| **PES** | 1 | | |
| **PEC** | 0.65 | 1 | |
| **AVE** | 0.72 | 0.75 | |
| **CRC** | 0.85 | 0.86 | |

| | PES | PEC | PE | $R^2$ |
|---|---|---|---|---|
| **PES4** | 0.81 | | | 0.66 |
| **PES5** | 0.84 | | | 0.70 |
| **PES6** | 0.88 | | | 0.77 |
| **PES7** | 0.85 | | | 0.72 |
| **PEC4** | | 0.85 | | 0.72 |
| **PEC5** | | 0.87 | | 0.76 |
| **PEC6** | | 0.86 | | 0.74 |
| **PEC7** | | 0.87 | | 0.76 |
| **PES** | | | 0.84 | 0.71 |
| **PEC** | | | 0.76 | 0.58 |
| **AVE** | 0.61 | 0.72 | 0.65 | |
| **CRC** | 0.85 | 0.86 | 0.80 | |

R- $\chi^2_{19}$ : 179.95; R-RMSEA: 0.13; SRMR: 0.05; R-CFI= 0.85

1-OR: First-Order Confirmatory Factor Analysis; 2-OR: Second-Order Confirmatory Factor Analysis. *Second Order: tau-equivalent latent variables (First and Second Order Models are equivalents).

## TABLE 5: First and Second Order CFA: Internal and External Patterns

**1-OR. CFA. PIP-PIM-PES-PEC**

| | PIP | PIM | PES | PEC | $R^2$ |
|---|---|---|---|---|---|
| **PIP4** | 0.76 | | | | 0.58 |
| **PIP5** | 0.82 | | | | 0.67 |
| **PIP6** | 0.80 | | | | 0.64 |
| **PIP7** | 0.84 | | | | 0.71 |
| **PIM4** | | 0.75 | | | 0.56 |
| **PIM5** | | 0.86 | | | 0.74 |
| **PIM6** | | 0.84 | | | 0.71 |
| **PIM7** | | 0.85 | | | 0.72 |
| **PES4** | | | 0.81 | | 0.66 |
| **PES5** | | | 0.84 | | 0.71 |
| **PES6** | | | 0.88 | | 0.77 |
| **PES7** | | | 0.85 | | 0.72 |
| **PEC4** | | | | 0.85 | 0.72 |
| **PEC5** | | | | 0.87 | 0.76 |
| **PEC6** | | | | 0.86 | 0.74 |
| **PEC7** | | | | 0.87 | 0.76 |
| **PIP** | 1 | | | | |
| **PIM** | 0.75 | 1 | | | |
| **PES** | 0.22 | 0.15 | 1 | | |
| **PEC** | 0.24 | 0.32 | 0.65 | 1 | |
| **AVE** | 0.65 | 0.68 | 0.72 | 0.75 | |
| **CRC** | 0.81 | 0.83 | 0.85 | 0.86 | |

R- $\chi^2_{98}$ : 569.31; R-RMSEA: 0.10; SRMR: 0.04; R-CFI= 0.71

**2-OR. CFA. PI-PE**

| | PIP | PIM | PES | PEC | PI | PE | $R^2$ |
|---|---|---|---|---|---|---|---|
| **PIP4** | 0.76 | | | | | | 0.58 |
| **PIP5** | 0.82 | | | | | | 0.67 |
| **PIP6** | 0.80 | | | | | | 0.64 |
| **PIP7** | 0.84 | | | | | | 0.71 |
| **PIM4** | | 0.75 | | | | | 0.56 |
| **PIM5** | | 0.86 | | | | | 0.74 |
| **PIM6** | | 0.83 | | | | | 0.69 |
| **PIM7** | | 0.85 | | | | | 0.72 |
| **PES4** | | | 0.82 | | | | 0.67 |
| **PES5** | | | 0.84 | | | | 0.71 |
| **PES6** | | | 0.88 | | | | 0.77 |
| **PES7** | | | 0.85 | | | | 0.72 |
| **PEC4** | | | | 0.85 | | | 0.72 |
| **PEC5** | | | | 0.87 | | | 0.76 |
| **PEC6** | | | | 0.86 | | | 0.74 |
| **PEC7** | | | | 0.87 | | | 0.76 |
| **PIP** | | | | | 0.86 | | 0.74 |
| **PIM** | | | | | 0.87 | | 0.76 |
| **PES** | | | | | | 0.84 | 0.71 |
| **PEC** | | | | | | 0.76 | 0.58 |
| **PI** | | | | | 1 | | |
| **PE** | | | | | 0.32 | 1 | |
| **AVE** | 0.65 | 0.68 | 0.72 | 0.75 | 0.75 | 0.65 | |
| **CRC** | 0.81 | 0.83 | 0.85 | 0.86 | 0.87 | 0.80 | |

R- $\chi^2_{99}$ : 576.97; R-RMSEA: 0.10; SRMR: 0.04; R-CFI= 0.70

1-OR: First-Order Confirmatory Factor Analysis; 2-OR: Second-Order Confirmatory Factor Analysis.

**TABLE 6: First-Order CFA: Practices**

| | PRACTICES SUPPLIER | | PRACTICES CUSTOMER | |
|---|---|---|---|---|
| | Pr-ES | $R^2$ | Pr-EC | $R^2$ |
| PrS1 | 0.27 | 0.07 | 0.30 | 0.09 |
| PrS2 | 0.25 | 0.06 | 0.29 | 0.08 |
| PrS3 | 0.14 | 0.02 | 0.19 | 0.04 |
| PrS4 | 0.26 | 0.07 | 0.25 | 0.06 |
| PrS5 | 0.30 | 0.09 | 0.32 | 0.10 |
| PrS6 | 0.81 | 0.66 | 0.83 | 0.69 |
| PrS7 | 0.94 | 0.88 | 0.92 | 0.85 |
| AVE | 0.26 | | 0.27 | |
| CRC | 0.42 | | 0.44 | |
| | R- $\chi^2_{14}$ : 74.33; R-RMSEA: 0.10; SRMR: 0.07; R-CFI: 0.88. | | R- $\chi^2_{14}$ : 59.52; R-RMSEA: 0.85; SRMR: 0.06; R-CFI= 0.92. | |

| | PRACTICES SUPPLIER-CUSTOMER | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pr_PP | Pr-EDI | Pr-IK | Pr-PC | Pr-DF | Pr-LSE | $R^2$ |
| PrS1 | 0.81 | | | | | | 0.66 |
| PrS2 | | 0.97 | | | | | 0.94 |
| PrS3 | | | 0.82 | | | | 0.67 |
| PrS4 | | | | 0.87 | | | 0.76 |
| PrS5 | | | | | 0.83 | | 0.69 |
| PrS6 | | | | | | 0.82 | 0.67 |
| PrS7 | | | | | | 0.94 | 0.88 |
| PrC1 | 0.87 | | | | | | 0.76 |
| PrC2 | | 0.93 | | | | | 0.86 |
| PrC3 | | | 0.92 | | | | 0.85 |
| PrC4 | | | | 0.83 | | | 0.69 |
| PrC5 | | | | | 0.95 | | 0.90 |
| PrC6 | | | | | | 0.82 | 0.67 |
| PrC7 | | | | | | 0.91 | 0.83 |
| Pr_PP | 1 | | | | | | |
| Pr-EDI | 0.29 | 1 | | | | | |
| Pr-IK | 0.25 | 0.04 | 1 | | | | |
| Pr-PC | 0.18 | 0.09 | 0.14 | 1 | | | |
| Pr-DF | 0.24 | 0.13 | 0.11 | 0.26 | 1 | | |
| Pr-LSE | 0.31 | 0.26 | 0.16 | 0.28 | 0.31 | 1 | |
| AVE | 0.71 | 0.90 | 0.76 | 0.73 | 0.80 | 0.76 | |
| CRC | 0.84 | 0.95 | 0.87 | 0.85 | 0.89 | 0.87 | |

R- $\chi^2_{62}$ : 423.80; R-RMSEA= 0.11; SRMR=0.03; R-CFI= 0.90

**FIGURE 1: Conceptual framework for the research and Hypotheses**

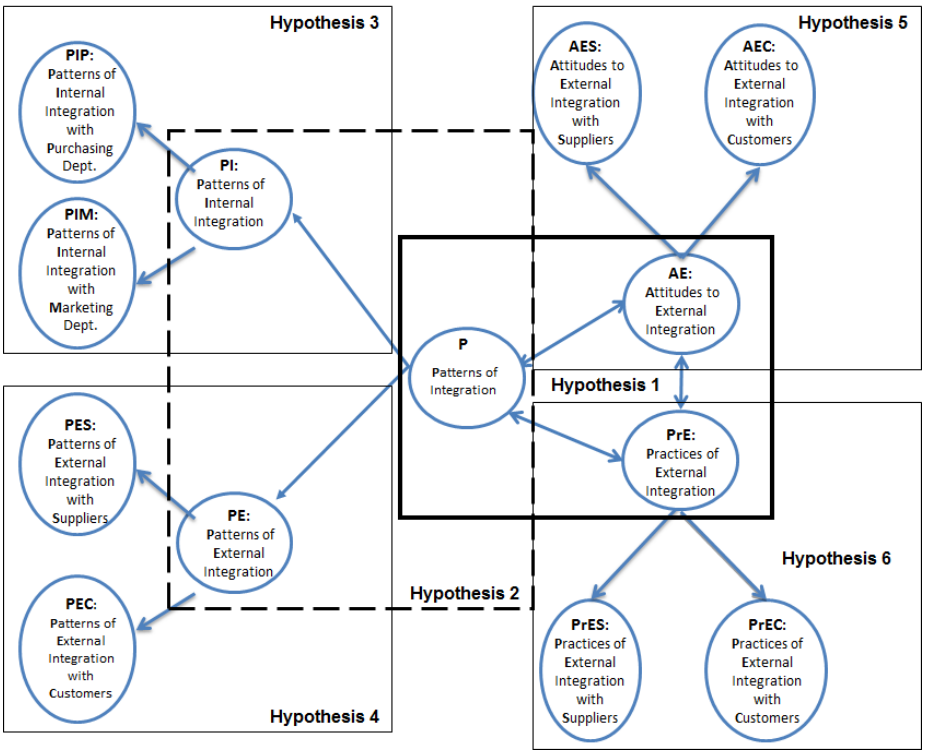


**FIGURE 2: Attitudes and Patterns relationships**